

HAND BOOK ON PRESERVATION OF BOTANICAL SPECIMENS

Tmt.M.N.Pushpa
Curator, Botany section.



Published by
Director of Museums
Government of Tamil Nadu

**HANDBOOK ON
PRESERVATION OF BOTANICAL SPECIMENS**

BY

Tmt. M.N. PUSHPA, B.Sc, M.A.,

Curator, Botany Section,

Government Museum, Chennai - 600 008.

New Addition Natural History Section, Volume XIV.

Director of Museums,

Government Museum, Chennai - 600 008.

First Edition : 1997

Second Edition : 2006

©

Director of Museums, Chennai - 600 008.

Price : **Rs. 20/-**

CONTENTS

TITLE	PAGE NO
Preface	1
Foreword	3
Felicitation	5
Foreword	7
Introduction about Botany	1 - 5
Preservation of Botanical Specimens	6 - 12
Preparation of Leaf skeleton	13 - 14
Artificial Leaf in paper and plaster of paris	
Preparation of Mushroom Model	15
Preparation of wax Model	16
Staining Procedure in Slide Preparation	17 - 18
Botanical Library & Garden	19 - 20
Botanical Survey of India	21
Illustrations	22 - 31
Bibliography	32

PREFACE

My present Handbook on 'Preservation of Botanical Specimens', is only an initiative taken in teaching about the basic principles in the preservation of plants. Since this Handbook is released on the occasion of the Vocational Training Course, methods of modelling in clay, wax and plaster cast are also included in this.

I am much thankful to the then Commissioner Thiru. K. Dheenadhayalan, I.A.S., and Deputy Director Dr. N. Devasahayam, who have been instrumental in bringing out this Handbook. My thanks are due to my sectional staff, office staff, including the printing press, the then D.T.P operator Thiru. K. Rajendran now Junior assistant and Xerox operator Thiru. B. Shankar presently the Duty clerk.

Since this book has been completely exhausted and much needed by different sects of people the necessity for reprint has arisen. My sincere thanks are due to the present Director of Museums, Thiru M.A.Siddique, I.A.S., who has approved the reprint of this publication, at the right time.

Place: Chennai-600 008
Date : 3.3.2006.

M..N. Pushpa,
Curator, Botany Section,
Government Museum,
Egmore.

FOREWORD

Government Museum, Chennai which is well renowned for it's collections has ten different faculties. Among these the Botany section comprising of systematic and Economic Botany galleries is located in the second floor of the main building. This section has been conducting regular Special Exhibitions, Seminars, lectures and courses. 'Preservation of Botanical specimens', course, is conducted during the month of May every year. This year, there is something special about this course, as the students of Bharathi Women's College, North Chennai will be undergoing this training under U.G.C. assistance, as a job oriented training, during the month of June.

I appreciate the sincere efforts taken by Tmt. M.N. Pushpa. Curator, Botany Section in conducting this course, co-ordinating the various institutions. This Handbook gives a brief to the students and the public, all the methods of preserving the Botanical specimens. The author has also mentioned about the techniques of making the Botanical models in plaster-of-paris and wax. I am sure this book would definitely serve the needs of the students, scholars and public.

I congratulate Tmt. M.N. Pushpa, in bringing out this useful publication and wish her success in all her endeavours of like kind.

Place : Chennai

Date : 29.05.97.

K. DHEENADHAYALAN. I.A.S.,

Commissioner of Museums.

FELICITATION

Botany Section of this Museum is well known for its various educational activities, apart from the gallery routine maintenance, in addition to conducting "The Preservation of Botanical specimens", course annually for Laboratory assistants, teachers and lecturers is a laudable achievement of the section. Subsequently the course's scope was enlarged as "Preservation of Biological specimens". The trainees are able to learn how to combine both the Zoological and Botanical preserved specimens while trying to establish the dioromic form of case set up. This publication of 'Preservation of Biological specimens', is brought out on this special occasion of the inauguration of the 28th training programme to a batch of 29 students (1st B.Sc. Zoology), from Bharathi Women's College Chennai-108, under the U.G.C assistance as a job oriented training.

This handbook now prepared, definitely serves as a guide line to know about the basic principles of preservation of Botanical specimens.

I wish the author Tmt. M.N. Pushpa, all success in her efforts and congratulate her in bringing out this special Publication.

Place : Chennai

Date : 29.05.97

Dr.N.DEVASAHAYAM,

Deputy Director of Museum.

M.A. Siddique, I.A.S.,
Director of Museums.

Government Museum,
Egmore, Chennai - 600 008.
Tel No. : 044-28193778
Fax No. : 044-28193035

FOREWORD

Government Museum, Chennai is well renowned for its collections. Among the ten different faculties is the Botany section which maintains vast plants representing the flora of Tamil Nadu highlighting the economic value of plants. This section has been conducting Special exhibitions, Seminars and Courses on Preservation of Botanical Specimens. This hand book was brought out during the first vocational training course offered to the 1st year students of the Bharathi Women's college, Chennai under the UGC assistance by this museum in the year 1997.

The illustrations in this hand book are described in a simple manner, through outline drawings. This book had served not only the students who studied botany but also the Botanists. This hand book is one of the contributions of Tmt. M.N.Pushpa, Curator, Botany Section. Her contribution to the Botany section of the Museum is appreciable. I look forward to her writing many more books in this field.

Since this hand book has gone out of stock, the reprinting of the book was felt necessary. I hope this book would serve those who are interested in the preservation of botanical specimens.

Chennai - 600 008.
16.3.2006

M.A.Siddique
Director of Museums

Colour preservation of green algae:

It is preserved with colour by treating them with 1% solution of copper acetate in 2% formalin. The algae is soaked in this solution for twenty four hours and later washed and preserved in 5% formalin.

Preservation of fungi

Fungi with small fructifications can be preserved in the home press. In the case of large woody fructification, thin sections may be taken and kept in the home-press. Hard fructification can be slowly dried by keeping it inside a glass container covered with a lid, leaving a small gap and kept in the sun. The moisture is wiped dry. The process is repeated till the amount of moisture given out by the specimen is reduced, after which the drying is stopped.

It is then poisoned with a saturated solution of alcohol with mercuric chloride and allowed to dry in the shade without pressure. After this, 2 or 3 coatings of varnish is applied. Flethy fructification of fungi is preserved in 5% formalin or 75% alcohol.

Preservation of Lichens

It is dried in the home press. Lichens that do not admit pressure are preserved like the woody fungal fructification. It is poisoned with 1.25% solution of corrosive sublimate in alcohol.

Preservation of Bryophytes with color

Soon after collection the Bryophyte is subject to moderate pressure. Saturated solution of copper acetate in glacial acetic acid is prepared which is diluted by adding 4 parts of water to every one part of the solution. Specimen tied to a string at one end is placed in the solution and heated nearly to its boiling point. It is then taken out washed and preserved in 5% formalin.

For dry preservation, 1.25% of alcoholic solution of corrosive sublimate is used.

METHODS OF PRESERVING THE BOTANICAL SPECIMENS

I. Introduction about Botany

PLANT TAXONOMY

Taxonomy is defined as the “Science of the classification of organisms according to their resemblances and differences”. The word systematics is often used synonymously with taxonomy. The systematics is the “part of classification that involves the arrangement of organisms” into related groups.

The Greek meaning of taxonomy is “arrangement by rules” and of systematics is “to put together”. The term Taxonomy was first coined and used by the famous French Botanist A.P de Condole in 1813 in his book “Theorie Elementaire de la Botanique”.

Taxonomy has four basic components. They are classification, identification, description and nomenclature.

Introduction of mathematical data, statistical details and the use of computers in the recent past have brought tremendous changes in the field of taxonomy. The use of Electron-microscopy in several cases has entirely changed the old concepts.

HISTORY OF PLANT TAXONOMY

The pre literate mankind also possessed some kind of linguistic mechanisms for correct distinctions among different kinds of plants.

Theophrastus the “grand father of the modern Botany” was the greatest botanical writer of the past. He was a student of Plato and Aristotle. He classified the plants into four groups, namely herbs, subshrubs, shrubs and trees.

Carl Linnaeus is the creator of the modern system of nomenclature, and also called as the 'Father of Modern taxonomy'. He was the originator of the sexual system of classification in which he recognised 24 classes based mainly on the basis of number, length, union and certain other characters of stamens. He was the first man to use the Binomial system of Nomenclature in which each organism is represented first by its generic name followed by the name of its species.

The best and a highly recognised natural system of classification was proposed by George Bentham and Hooker. They classified plants strictly on the basis of natural system. They presented their well known system of Classification in their book titled "Genera plantarum".

WHAT IS CLASSIFICATION?

Classification is the placement of plants, animals and objects into groups and categories for a clear understanding, proper study and effective organisation.

PLANT COLLECTION AND SPECIMEN PREPARATION

Plant collection and field preparation of specimens are the fundamental aspects of study, training and research in plant systematics. Herbarium specimens are the permanent records of plant species of a particular place at a given time. Therefore, the plants should be carefully collected, selected and the herbarium specimens should be properly prepared and preserved.

HOW TO IDENTIFY PLANTS

Identification is the basic process of classification. It is the determination of the group to which a specimen belongs. The process of identification usually includes a direct comparison of an unknown specimen with the already classified, circumscribed, and named taxa.

NOMENCLATURE

Assignment of definite names to plant is called 'Nomenclature'. In the present Botanical world, Nomenclature involves the principles governed by rules formulated and adopted by International Botanical Congress. Botanical names are either Latin word or words that have Latinized from Greek or some other language.

MODERN TRENDS IN PLANT TAXONOMY

It is true that morphological characters of the plants have provided the foundation and framework for taxonomy. The disciplines like plant anatomy, cytology, palynology, embryology, ecology, genetics, plant geography have played a significant role in plant taxonomy. The old ideas of classification and phylogeny of the plants have changed enormously- because of the newer aspects of taxonomy such as biosystematics, cyto taxonomy, chemo taxonomy etc.

Terms to be known in Taxonomy

NUMERICAL TAXONOMY

The analysis of various types of taxonomic data by mathematical or computerized methods is called 'Numerical Taxonomy' or 'Taximetrics'. This approach of systematics involves the numerical evaluation of the similarities or affinities between taxonomic units, and then arrangement of these units into taxa on the basis of their affinities.

Adanson, a French Botanist, was the first to put forward a plan for assigning numerical values to the similarity between organisms.

Groups of similar organisms recognised by numerical methods are called 'phenons'. Phenons are equivalent to various taxonomic groups.

CHEMOTAXONOMY

The approach of Taxonomy in which chemical features of plants are used in developing classifications or in solving Taxonomic problems is called 'Chemotaxonomy'. Some of the basic chemical features are like alkaloids, flavoroids, carotenoids, polysacharides, terpenoids, fatty acids, amino acids, aromatic compounds, etc.

Chemotaxonomy has been used at all levels of the hierarchy of classification starting from the rank of variety up to the rank of 'Division' in plants.

SERO TAXONOMY

The application or utility of serology in solving taxonomic problems is called 'Sero taxonomy'. The study of antigen-antibody reactions is called 'Serology'.

PHYLOGENY

The history of development of a race or simply evolutionary history is called 'Phylogeny'.

ANGIOSPERMS

The flowering plants are called 'Angiosperms'. Angiosperms have the greatest number of plant species (over 3,00,000 species) inhabiting the earth. They include annuals, perennials, herbs, shrubs and trees, ranging from very small to gigantic sizes.

HERBARIUM

A collection of dried and pressed plants arranged according to a classification system and available for study or reference is known as 'Herbarium', a name first applied by Linnaeus. Luca Ghini of Italy has been the initiator of the art of Herbarium.

A Herbarium may contain a few hundred locally collected plant specimens kept in a small place, or it may contain millions of the plants collected from different parts of the world and housed in a very big building. 'Herbaria' in different countries remain associated with Colleges, Universities, Scientific Societies, Research Institutes, Botanical gardens, or well-funded government organisations. There are also private Herbaria.

The world's largest Herbarium is at the Museum of Natural history, Paris which contains over 6.5 million plant specimens. The Royal Botanical Garden, Kew, England contains over 5 million specimens. The biggest Indian Herbarium collection is with the Botanical Survey of India at Calcutta holding over 1.3 million specimens.

A modern Herbarium is a research training and service institution that serves as reference centre, with documentation facility and a data store house. It includes diverse collections of flowering plants, gymnosperms, ferns, mosses, liverworts, lichens, fungi, algae and fossils. The Botanical Survey of India's Southern Circle Herbarium, Coimbatore contains over 1,75,000 specimens.

II. PRESERVATION OF BOTANICAL SPECIMENS

In this day-to-day life, man is completely dependent on plants for food shelter and clothing. Besides imparting knowledge of Taxonomy and systematics of the plants, Botany also helps in the dissemination of knowledge of Ecology and Economy as natural resources. Botanical remains in the archaeological finds tells the relative age of the object through the process of carbon dating. Tree ring analysis of wooden articles gives us a rough idea of the climatological data of the period to which they belong.

Plant life as a whole are classified as follows.

1. THALLOPHYTES

- Bacteria - Unicellular and microscopic.
- Algae - Aquatic or marine. Some are terrestrial.
- Fungi - Microscopic. Parasitic or Saprophytic.
- Lichens - A combination of algae and fungi.

2. BRYOPHYTES - Liverworts and Mosses.

No differentiation into root, stem and leaves.

3. PTERIDOPHYTES

Clubmoss

Lycopodiales

Horsetails

Ferns

Stem within the soil called as 'rhizhome' are present. Young leaves coiled like watchspring with spores in the margin are visible.

4. GYMNOSPERMS - Cycas, Pines

They are trees with exposed ovules and pollen grains.

5. ANGIOSPERMS - Classified as

Monocotyledon

Dicotyledon

Botanical specimens are Classified as follows :

1. Dry
2. Wet
3. Models - plaster, clay, wax, papermachie, fibre etc.
4. Picture - ink drawing, watercolour, oil paint, photographs etc.

NEED FOR PRESERVATION

'Herbarium', are flattened specimens devoid of their colour and are prone to attack by insect or fungi, which cause putrefaction. Bacteria causes decay. Hence the necessity arises to preserve them.

Collection of plants:

The plant as far as possible has to be collected with roots. Larger specimens like grass can be folded and kept. In the case of woody trees and shrubs, ends of shoots or branches are taken with fruits and flowers collected separately.

Materials for collection:

1. Vasculam – It is a tin box.
2. Portfolio - They are wooden frames for keeping specimens in blotting paper.

Preservation of Algae:

After the specimen is collected, it is placed in a basin of water and lightly agitated with a quill so that the filaments float in a natural way. It is then mounted on a blotting sheet. The specimen is covered with tissue paper and dried in the home press.

1. Marine algae or seaweeds are preserved in 2% solution formalin in seawater.
2. Melanospermous algae are put into boiling water until all the mucus is given out.
3. Charales, which have calcareous contents should be preserved only in 50% solution of alcohol in water.
4. Fresh water algae may be preserved in 5% solution of formalin in fresh water.

Preservation of Pteridophytes

They are treated with copper acetate and glacial acetic acid.

Club-moss and horse-tail are kept in boiling water for two minutes and hung up in the air to dry. They are then poisoned with corrosive sublimate in alcohol.

Preservation of Gymnosperms

Wet preservation: Leaves are immersed in boiling water for a few minutes and preserved in 5% formalin. Colour is preserved with copper acetate and glacial acetic acid.

Dry preservation: Cones are poisoned by using saturated solution of alcohol with mercuric chloride.

Preservation of Angiosperms

Smaller plants should be collected entirely with root, stem and flowers. Larger plants should be bent as many times as necessary. In the case of brittle plants, as much of the plant as possible from the ends of shoots and branches could be collected.

Materials needed for collection :

1. Vasculam
2. Portfolio
3. Penknife
4. Pocket lens
5. Field note
6. Driers - Either newspaper or blotting sheets.

In the field note, the following details should be recorded.

1. Habit - whether a herb, shrub or a tree
2. Colour of the flower
3. Fragrance, if any

4. Locality
5. Local name
6. Collector's name
7. Date

Preparing the Herbarium

Longer specimens are folded and kept. It is laid in the drier without crumbling the leaves and flowers. Both sides of the leaves and flowers should be displayed. Specimen are distributed about the drier rather than confined to the centre.

Cumbersome parts such as tubers, corns and bulbs should be scooped out before drying. Aquatic plants are dried with dry napkin. Glutinous plants are sprinkled with talcom powder. Succulent plants are first immersed in boiling water. Specimens should be provided with number slip with reference to field notes. Layers of driers and specimens are repeated with pair of ventilators at regular intervals. Period of drying varies for different specimens, based on the type of driers used. Weight should be heavy enough to prevent wrinkling. Forceps are used to replace the plants in the drier.

For the first few days, daily change of sheets are required. Subsequently, it could be done on alternate days. Drying process is completed by its hay like rattle.

Preservation of flower

A flower is poisoned with 90% alcohol, 5% formalin and 5% acetic acid. Most flowers retain their colour if they are dried rapidly and ironed them hot. The leaf should not be charred. They are poisoned, with soft brush.

Specimens are fastened to the sheet with fevicol and the botanical name is given in the right corner of the herbarium along with the following details.

1. Collection number
2. Reference date
3. Collection date
4. Collector's name
5. Locality
6. Remarks

Herbarium specimens of one genus should be put in a cover. Periodical poisoning should be done. If moisture is seen even on one specimen, the entire collection should be poisoned. Napthalene keeps the herbarium pests away to a certain extent. They can be preserved in the fumigation chamber.

Dry fruits and seeds are preserved by slow drying without any pressure by keeping in the sunlight inside glass container.

Seasoning of timber is done by keeping it inside a glass jar with plenty of airspace and the mouth covered leaving a small gap and then placed inside an air-bath and warmed to the required temperature. After seasoning, two or three layers of spirit varnish coating is given as a protective layer.

GREEN COLOUR PRESERVATION OF PLANTS:

Powdered Copper sulphate with glacial acetic acid is dissolved in water in the ratio of 1:4. The plant selected for colour preservation is tied to a thin wire and kept suspended in that solution. The container is heated to a minimum temperature. After the heating process, the wire is taken out and dipped in fresh water and the specimen is finally transferred to 5% formalin solution.

ALTERNATIVE METHOD

About 100 grams of powdered copper acetate is mixed in 10% Formalin solution with the help of a glass stick. It is then slowly heated to let out the formalin vapours. After the evaporation of formalin the selected plant is kept in the solution for about 10 days to retain the green colour. vapours The plant is then preserved in a jar containing 10% formalin. By this method, the green colour is retained for a longer time.

3. PREPARATION OF LEAF SKELETON

30% washing soda, dissolved in water is heated in a glass container. When the solution reaches the boiling point, 7 grams of calcium hydrate is dissolved in the same solution. The heated solution is left to cooldown. The selected matured leaves are then put into the solution and left immersed in the same for 2 to 3 hours. Then the leaf is taken out and slightly rubbed with cotton swab applying very little pressure. If the epidermal layer does not peel off easily, the leaf is again immersed in the same solution for another 1/2 an hour. Again it is taken out and tried with the cotton swab. Care should be taken to see that when tissues are removed, the structure of skeleton is not damaged. After the epidermal tissues are completely taken out, the leaf skeleton is clearly visible. This is immersed in a saturated solution of Mercuric chloride for 1/2 an hour and then put inside the blotting sheet for a day or two. The leaf skeleton can be displayed on a black board or any other suitable dark colour, so that it is seen clearly.

PREPARATION OF ARTIFICIAL LEAF (Paper)

Procedure:

The sketch of the leaf is made on a brown sheet which is double folded. The outline is then cut with the scissors. Now the upper and lower half of the leaves will be obtained. In between the upper and lower half of the leaf a thin wire is pasted in the centre to give the structure of the midrib.

Length of the wire should be more than the length of the leaf. The extra wire coming out of the leaf serves as the leaf stalk. Through this method any type of artificial leaves can be prepared and it can be fixed on a dried bark for giving a natural appearance. This can be used in setting up a diorama show case.

PREPARATION OF ARTIFICIAL LEAF (In Plaster of Paris)

Select a thick leaf. Prepare the clay to three inches height in the form of quadrangular bed. Clay must be levelled with the help of a file or knife. Later the leaf is placed in the centre and pressed gently on the clay. Clay should not extend over the leaf and viceversa. The chalk powder is applied on the upper part of the clay embedding the leaf, after flattening the processed clay in a linear fashion on a gunny cloth, which facilitate the easy removal of clay. The flattened clay must be pasted on the four sides to serve as a wall. The leaf bearing part of the clay then has to be filled with plaster of paris solution, up to the wall level of the clay. After about half an hour, the plaster of paris solidifies. Without breaking it the leaf impression part of the block is turned above. The original leaf stuck on the clay must be removed and fixed properly on the block of plaster of paris. Clay wall is again formed as before. 1/4" groove is made on the upper four corners of the plaster of paris which will easen the removal of the block in to two halves. The groove on the upper part should be broader and narrow inside. The chalk

powder is applied again. After doing so, as earlier the plaster of paris solution is again poured on the exposed portion of the leaf up to the level of clay wall. Half an hour later, the clay wall is removed. With the help of a flat instrument, the middle portion of the plaster of paris mould is pressed carefully so that the two halves of the mould are removed. The leaf present in the centre is now removed and the two halves of the block are left to dry in the sunlight for two days.

The same leaf shape is then made on a thin cloth. Now molten wax is then applied on the innerside of both the halves of the plaster of paris block. (The wax applied should be to the thickness of the paper). Later the thin cloth cut to the leaf shape is kept inside the groove of the two parts of the plaster blocks and are tied together and it is heated slightly. This block is then soaked in water for 1/2 an hour. After cooling is completed, the two parts of the block gets separated individually. We can now see the leaf impression on the wax. Taking this leaf model out, the stalk is attached by means of a thin wire. Many leaves can be prepared by this method and they can be fixed on a dried branch to give a natural look. This is used in setting up the diorama show case.

IV. PREPARATION OF THE MUSHROOM MODEL

Procedure

First a clay mould of a live Mushroom is taken. As clay figurines are easily soluble and crackable they can not be used directly to take models. This forms the basis for taking plaster of paris model. Chalk powder tied in a thin cloth is applied on the clay mushroom model keeping it in a horizontal position. After the chalk powder is dusted on it, clay is applied all around the model and levelled using a saw plate. The thickness of clay should be one and a half inches all around. Then flattened clay strips should be fixed around the stuffed clay forming a

wall. Again the chalk powder is applied on it for facilitating the separation of the two parts of the block. Plaster of paris solution is now poured into the clay mould. Half an hour later, the wall of the clay is removed. Part of the clay mould filled with plaster of paris forms the upper part of the Mushroom. Now the other part of the Mushroom is kept on the upperside and the clay mould is taken in the same way.

Sunlight soap-powder mixed in coconut oil is now applied on all sides using a flat brush. To keep it in the position, clay strip is pasted below. Plaster of paris solution is now poured inside and left to set for half an hour. The clay mould mushroom existing in the centre is removed. Now the mixture of sunlight soap in coconut oil is applied on the inner and outer part and plaster of paris solution is poured inside and left for some time. By breaking open the two block the mushroom model in plaster of paris is got. By this method many models can be prepared using the same method. This will be of immense help in setting up mini - diorama show case.

V. PREPARATION OF WAX MODEL

The vegetable and fruits model can be taken by this method. The clay model of the chosen vegetable or fruit is prepared by the same method as mentioned before. Instead of plaster of paris, the paraffin wax is boiled with the appropriate colouring wax powder and is poured into the clay mould and left to cool down for about half an hour. The clay mould is then removed to get the vegetable or fruits model. This can be used for display in the show case, diorama case or for decorative purposes.

VI STAINING PROCEDURE IN SLIDE PREPARATION

The primary objective of staining a plant material is to differentiate the various cell types constituting the tissue system. Each cell type has a specific physical, chemical and biological property. Based on their physical and chemical properties, the material takes up a particular colour. The stain also increases the refractive index of the material thus enabling a better viewing of the material. For academic purposes, the commonly used stains are safranin and fast green.

For the preparation of a semi-permanent mount, the plant material has to be subjected through a series containing alcohol and xylene. The sectioned material is initially stained in safranin.

A flow chart of the various steps involved are as follows :

Staining in Safranin

Water

Alcohol 10% (Alcohol 10ml water 90ml)

Alcohol 20% (Alc-20 H₂O - 80)

Alcohol 35% DPX mountant Alcohol

Alcohol 50% 1.1 Alcohol xylene

Alcohol 65% Xylene (100% Alcohol 50ml.

Alcohol 75% 100% xylene 50 ml)

Alcohol 95% Fastgreen in 95 % alcohol

DPX mountant 100% Alcohol

The material needs to be stained excessively in safranin as, safranin is soluble in the alcohol. So the various changes in alcohol must be quick. The instrument used for changing the series must be moisture free. All the embryo caps used during the process must be sealed. The changes made in xylene should be totally moisture free.

The material is subjected to xylene treatment so as to increase the clarity of the material and also to increase the refractive indices of the material. Finally the material is transferred to a clean slide with a drop of mountant (DPX) and mounted using a cover slip. Such a slide can be labelled and preserved for a long time.

VII. BOTANICAL LIBRARY

A Botanical Library is a store house of botanical books, journals, periodicals, magazines, photographs, movies, newspapers, dissertations, etc. All printed materials, drawings, films, paintings and other similar articles belonging to the plant sciences are also stored in the library systematically. A Botanical library is useful to the systematists as an information source, a documentation centre, a data store house, and also as a service facility.

The major botanical libraries of the world are, the Library of Congress in Washington, U.S.A. the Library of the Academy of Sciences in Leningrad, the National Library of Beijing and Library of the British Museum in London.

Some major Indian Botanical Libraries are associated with the Botanical Survey of India, Calcutta, National Botanical Garden, Lucknow, Forest Research Institute, Dehradun and Indian Agriculture Research Institute, New Delhi.

BOTANICAL GARDENS

Botanical gardens are institutions that maintain living plant collections of different varieties of plants, including ornamental and cultivated ones. A botanical garden contains plant species from several corners of the globe. It also includes greenhouse, a library, and a herbarium, research laboratories, photographs, paintings, illustrations, re-prints, notebooks and specimens of several types. It is therefore not merely a garden but a Botanical institution.

Modern botanical gardens serve as centres for documentation, research reference, data storage, education, conservation and several other biological facilities to mankind.

At present there are over 600 botanical gardens in the world. The old Indian classics such as Mahabharat, Ramayan and Vedas have also mentioned about gardens. The hanging gardens of Babylon are considered among the wonders of the ancient world.

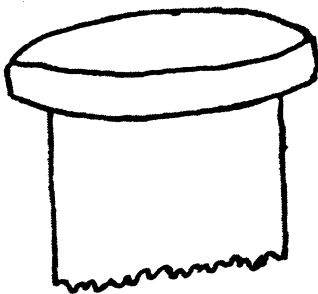
The credit of establishing the first botanical garden of the world goes to Luca Ghini an Italian professor of botany. He established botanic garden at Pisa Italy, Royal Botanical garden Kew, England is the largest botanical garden of the world.

MAJOR BOTANICAL GARDENS OF INDIA

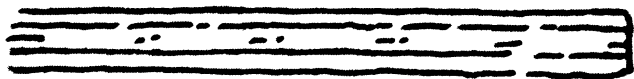
Indian Botanical Garden, Calcutta is the largest botanical garden in India. The other important botanical gardens are (1) Lalbagh or The Mysore Botanical garden (2) Lloyd Botanical garden, Darjeeling (3) National Botanical garden, Lucknow and (4) The Botanical garden of Forest Research Institute, Dehradun.

VIII BOTANICAL SURVEY OF INDIA

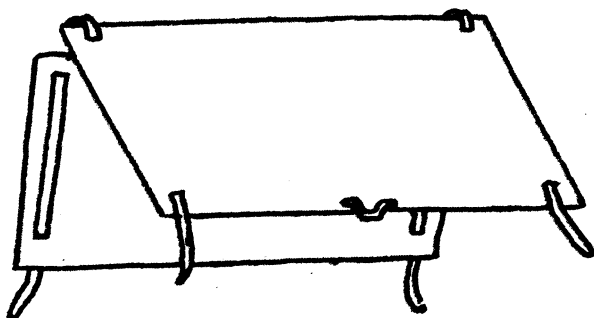
George King, the chief executive officer of the Royal Botanical Gardens, established the Botanical Survey of India 1890, with the main objective of coordinating the botanical work being done in different parts of India at that time. Now, the BSI headquarters office at kolkata coordinates the research and other activites of all units. The BSI links with other major research institutions of the country such as CSIR, ICAR, etc.



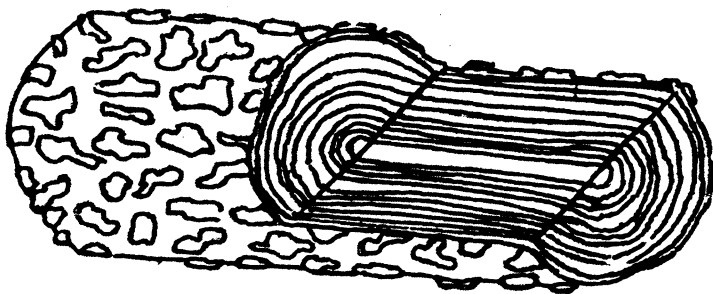
MOUTH OF SPECIMEN JAR SEALED WITH PARAFFIN



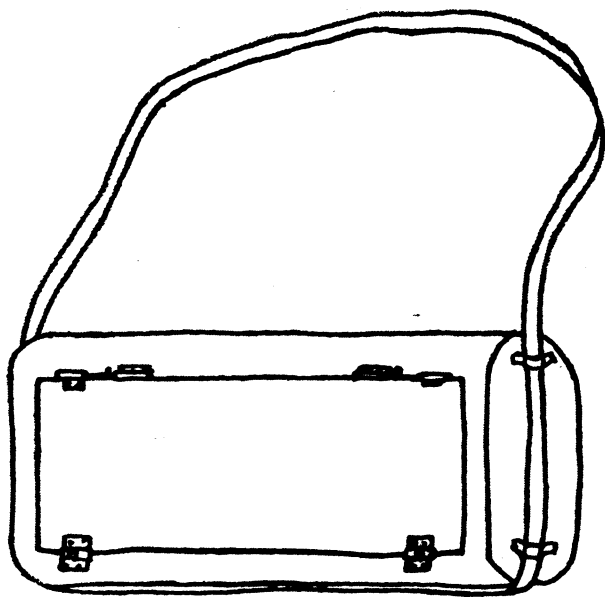
**A PAIR OF VENTILATORS FOR USE AS
OUTSIDE HOME-PRESS**



PORT FOLIO

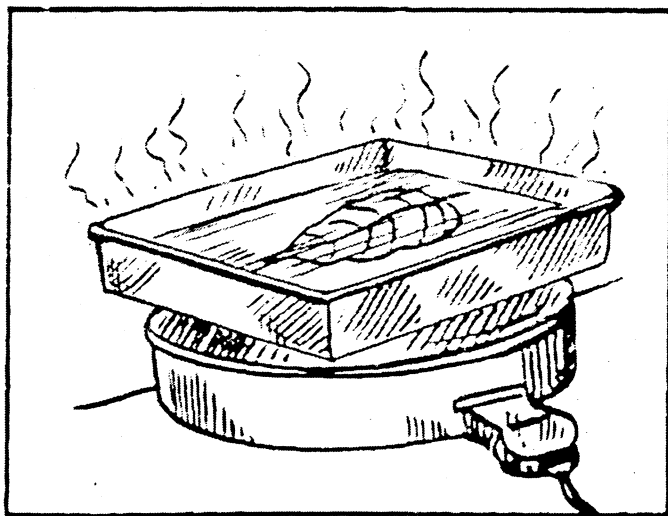
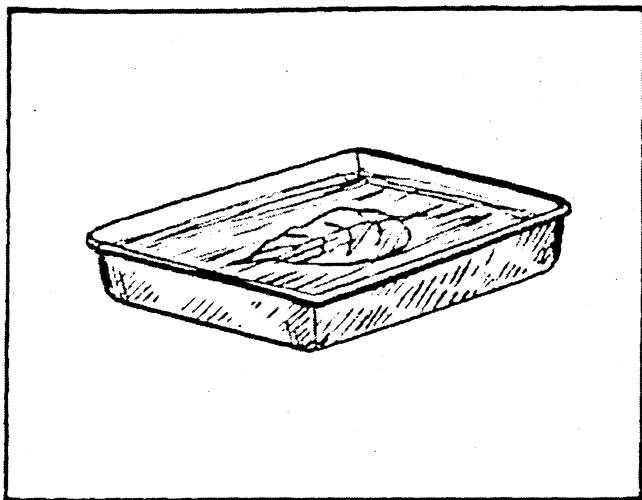


DISPLAY METHOD OF TIMBER EXHIBIT



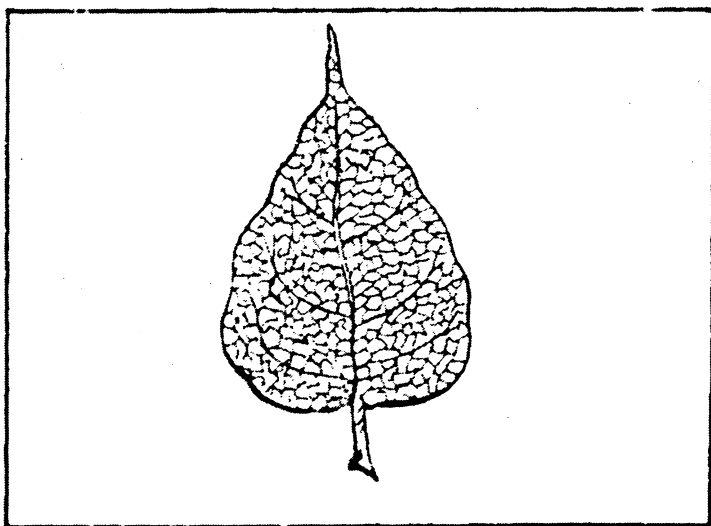
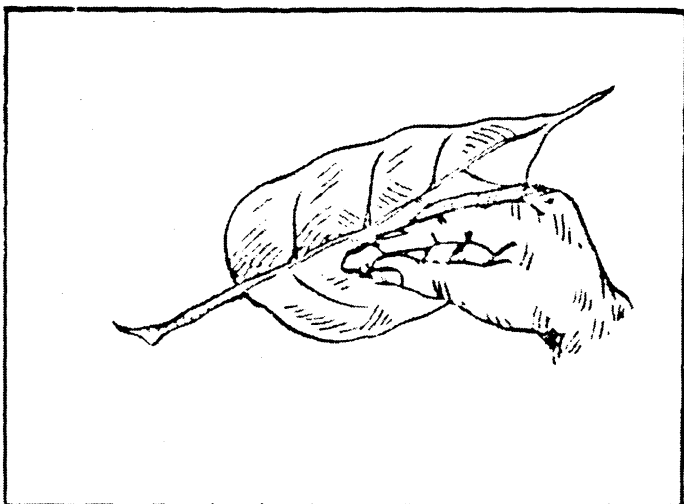
VASCULUM

LEAF SKELETON PREPARATION



**FICUS RELIGIOSA LEAF IN CAUSTIC
SODA SOLUTION**

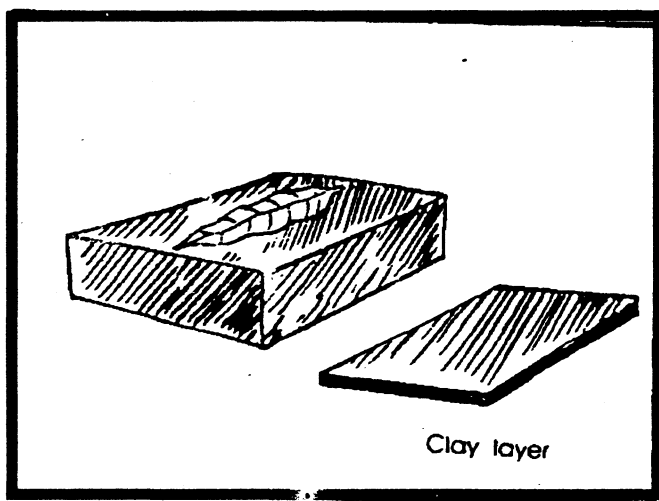
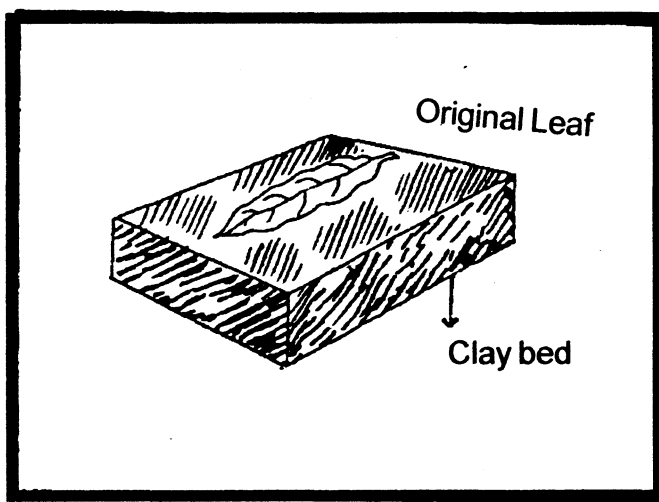
**REMOVING THE EPIDERMAL LAYER
WITH COTTON SWAB**

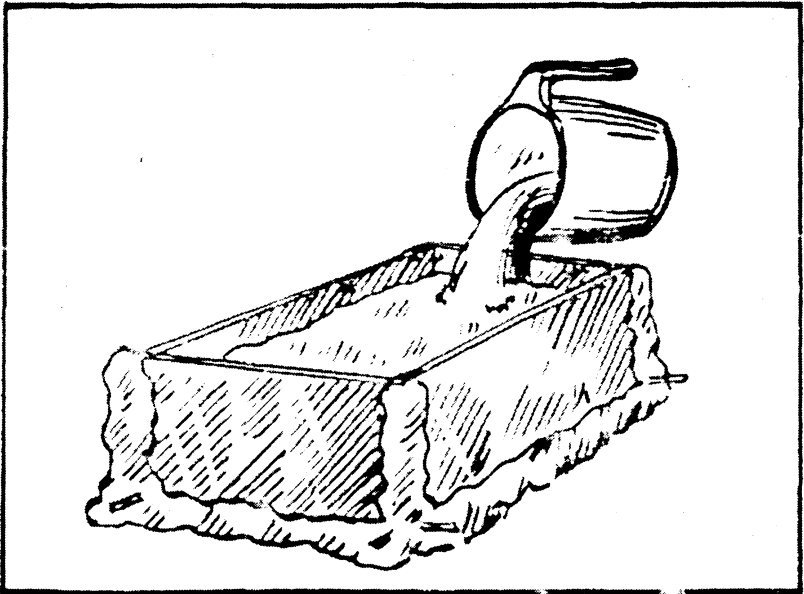
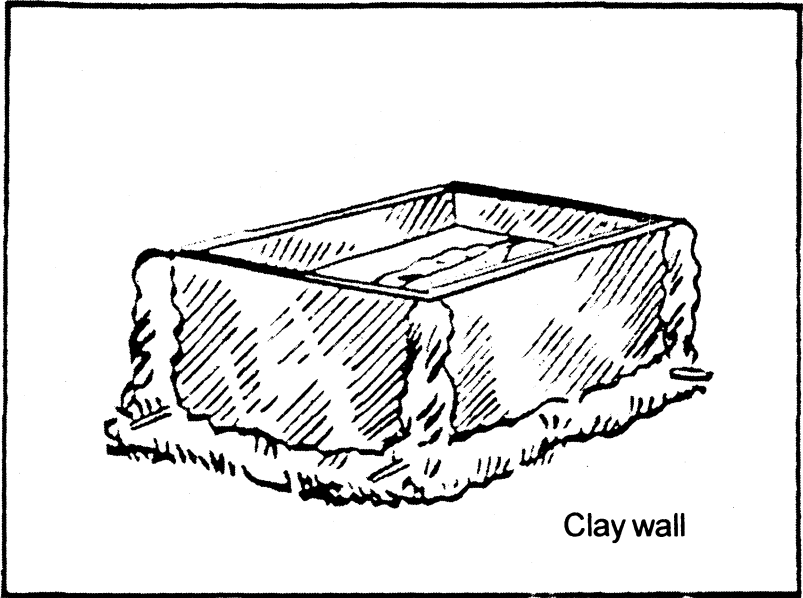


THE PIPUL LEAF SKELETON PREPARED.

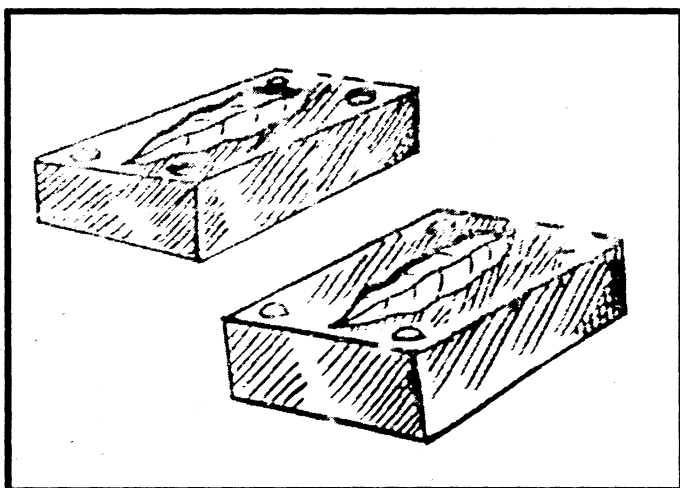
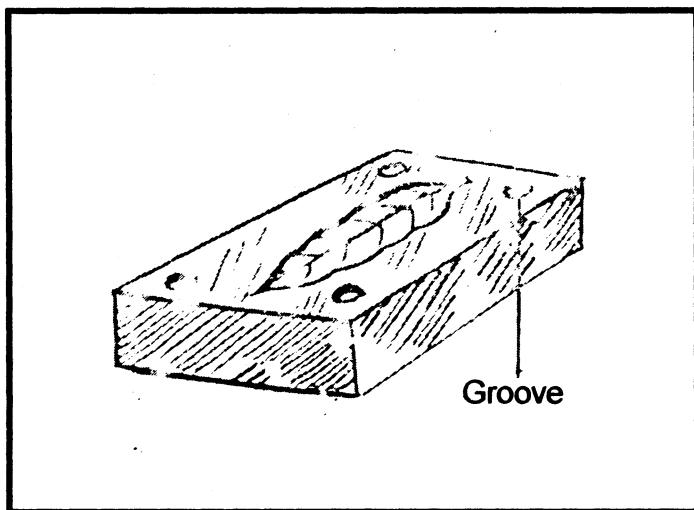
PREPARATION OF PLASTER CAST

LEAF-MODEL



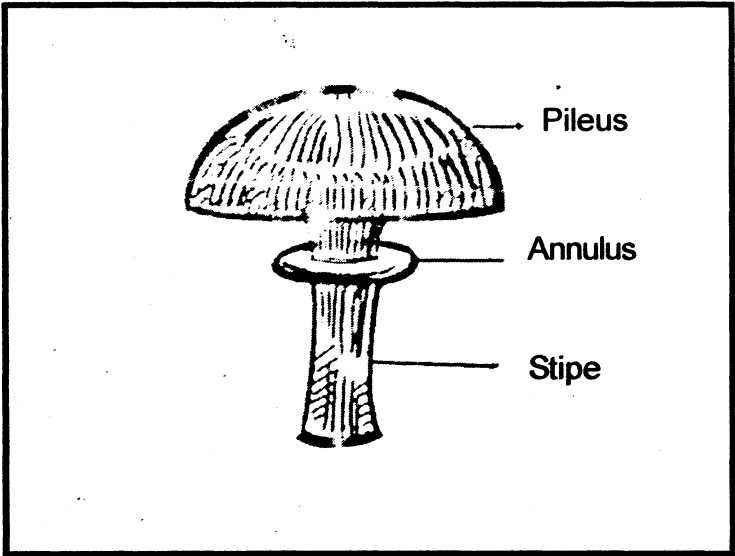
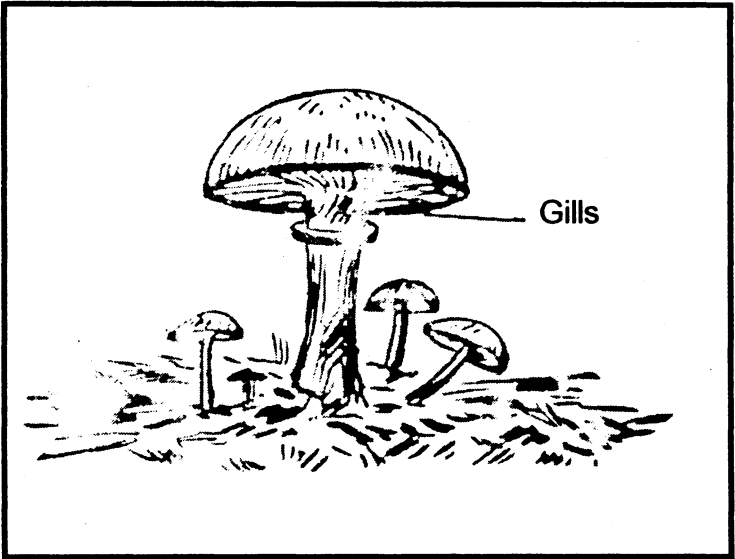


POURING THE PLASTER OF PARIS SOLUTION

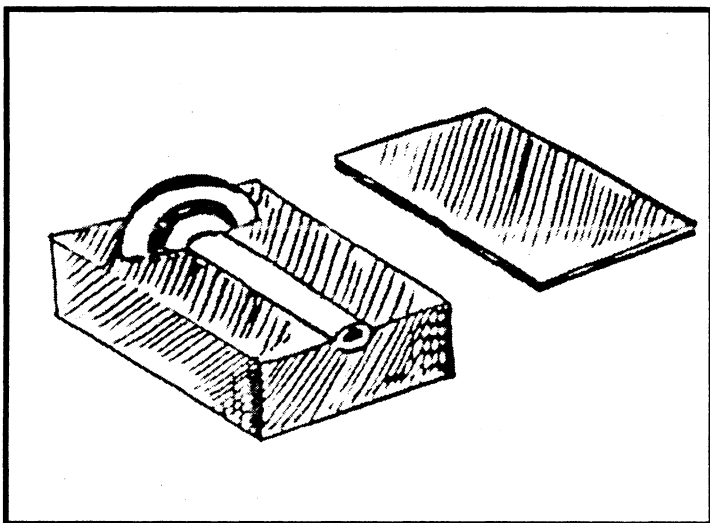
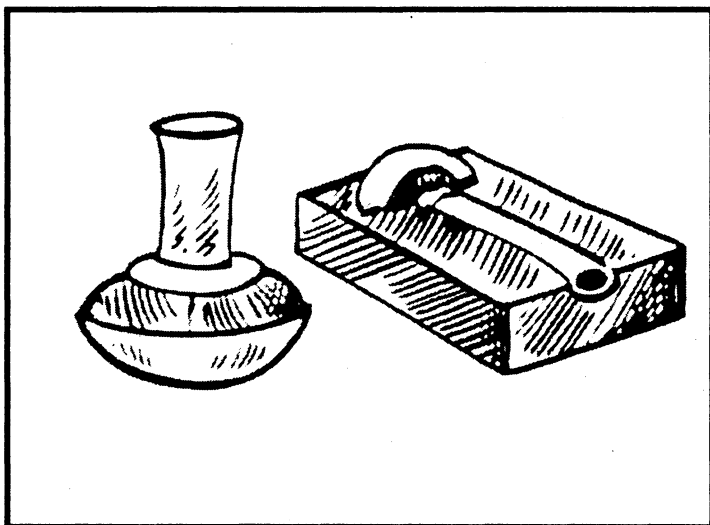


**DORSAL AND VENTRAL SIDE
LEAF IMPRESSION TAKEN**

MUSHROOM IN ITS NATURAL HABIT

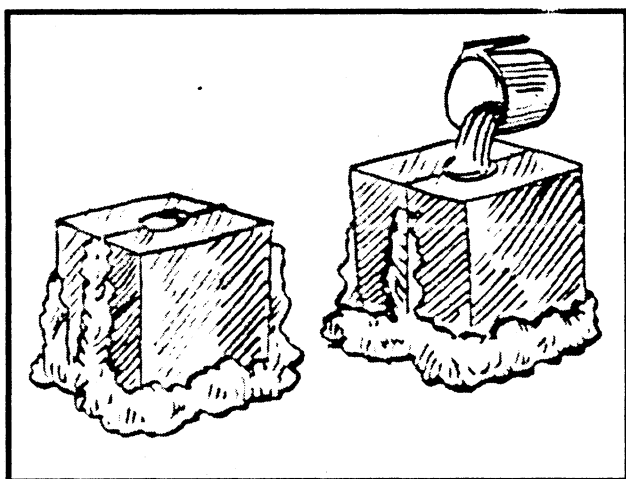
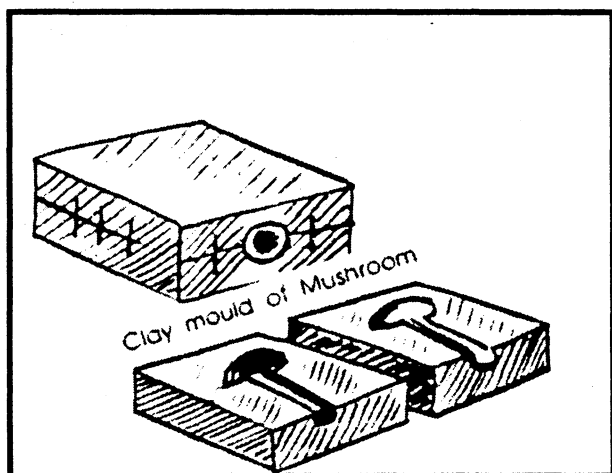


**UPPER HALF OF THE MUSHROOM KEPT ON
THE CLAY BED.**



**LOWER HALF OF THE MUSHROOM KEPT
ON THE CLAY BED**

IMPRESSION OF THE UPPER AND LOWER PART OF MUSHROOM TAKEN



POURING PLASTER OF PARIS SOLUTION IN THE CLAY MOULD.

ILLUSTRATIONS

Thiru M. Dominic Sabastine,
Artist Modeller, Thiruvavur

IX. BIBLIGRAPHY

1. Aiyappan, A& S.T.Satyamurti **Hand book of Museum Technique, Chennai, 1960.**
2. Bell, C.R **Plant variation and Classification, Maxmillan London, 1969.**
3. Heywood, V.H. **Plant Taxonomy, E. Edward Arnold Publishers, London. 1967**
4. Lam, H.J. **Taxonomy, General Principles and Angiosperms, Vistas in Bombay, 1959**
5. Radford **Fundamentals, Plantsystematics, Harper X Row, Newyork, 1986**
6. Satyamurti, S.T. **Hand book of the Madras Government Museum, Chennai, 1964**
7. Sharma, O.P. **Plant Taxonomy, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 1993**

**N.T.P. SUPPLIED BY THE DEPARTMENT
PRINTED AT GOVERNMENT CENTRAL PRESS, CHENNAI-600 079**

